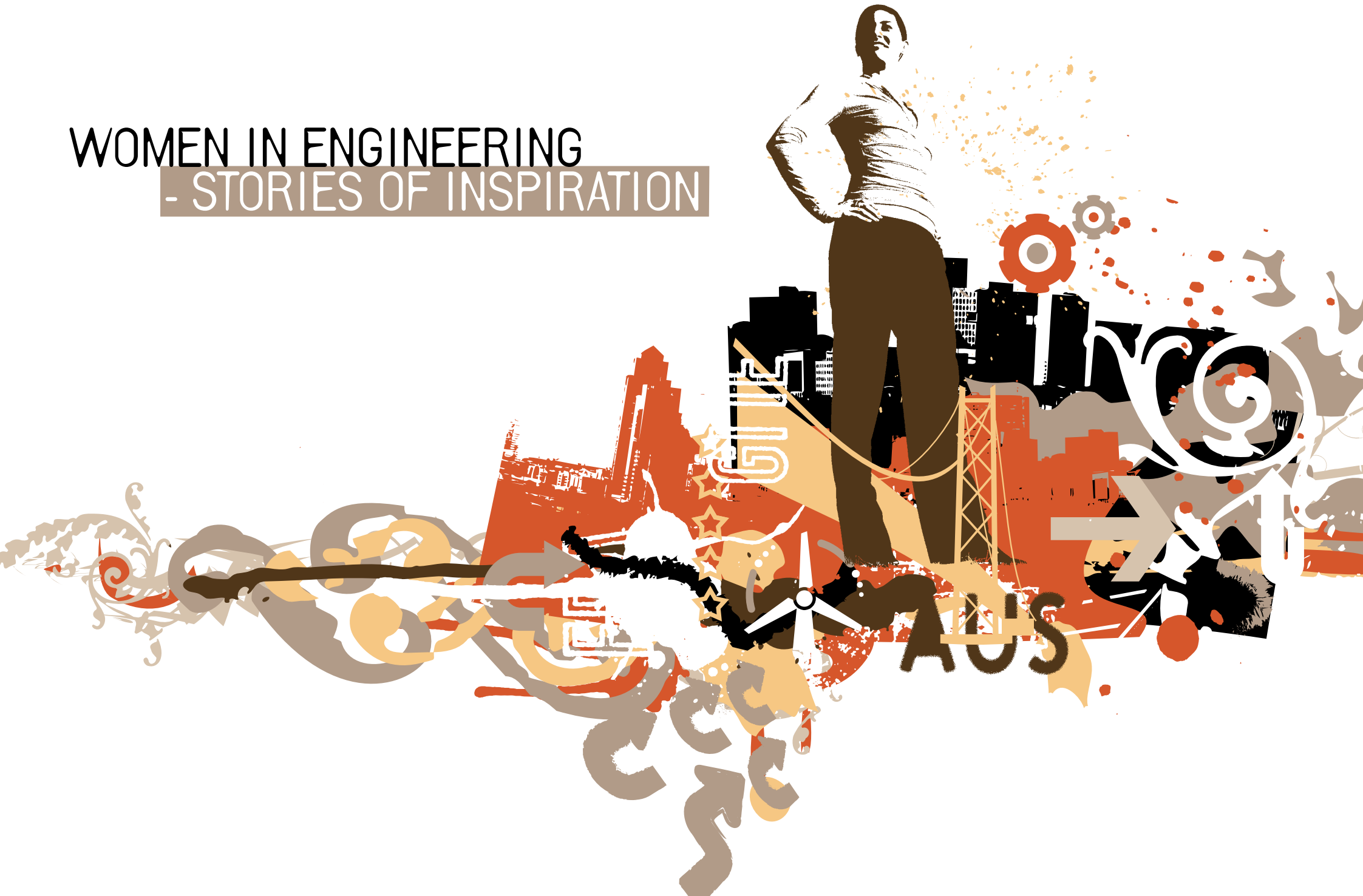


WOMEN IN ENGINEERING

- STORIES OF INSPIRATION

A vibrant, abstract collage featuring a woman in a blue shirt and black pants standing with hands on hips. The background is a mix of red, orange, and black geometric shapes, including gears, a city skyline, a wind turbine, and the letters 'AUS'. The overall theme is engineering and inspiration.

WOMEN IN ENGINEERING

- STORIES OF INSPIRATION



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ISBN 0 8582 5727 0

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Electronics Engineer
National President, Engineers Australia

Australian engineering companies and engineers are world class and Australia's female engineers are world class too. Engineers Australia has long recognised the talent of our female engineers and has spearheaded many initiatives to support them. Our most ambitious initiative to date was to declare 2007 as the 'Year of Women in Engineering' - Creative/Diverse/Inspiring.

The objectives of this major campaign were:

- > To increase awareness and understanding amongst the profession and wider community of the diversity, competence, influence and passion women have for engineering.
- > To promote Engineers Australia as a champion of women's issues by acknowledging the valuable and significant contribution women make across all engineering disciplines.
- > To promote to girls in high schools the opportunities and long-term career and lifestyle rewards that engineering offers women.

Our key messages are:

Engineering needs women

Attracting women to engineering will have benefits for the profession and the wider community. We cannot afford to have 50% of the population so under-represented in our profession.

Women are good for engineering

The profession and community benefit from an inclusive team as diversity realises better use of talent, increased workplace understanding, enhanced breadth of awareness in leadership positions, enhanced creativity and increased quality of team problem-solving.

Engineering is good for women

In the 21st century, engineering offers women both full-time and project-based opportunities. Flexible work practices and support frameworks increasingly allow for a better work/life balance.

The world needs women to be Engineers

Women engineers bring health, wealth and safety to the community and society. Women are equal consumers of technology and their input into the development and application of technology is critical. Engineers create the very fabric of society and govern the way in which we experience life. Women create life itself. Together, it makes a stunning combination.

This book is the culmination of a year that has been successful beyond our dreams. It celebrates the many achievements and important contributions women make to engineering teams and showcases to the profession and the wider community the diversity, competence, success, influence and passion of female engineers.

The accomplishments of the twelve women in this publication are real. These women have families, earn good incomes, travel the world and live fulfilling lives. These women have pursued their engineering careers with dedication and passion.

They are but a few of the many wonderful female engineers who are striving to make Australia and the world a better place.

Engineering is an exciting profession that drives change and improvement in our world. We live in exciting and complex times when the need for women's creativity and know-how has never been greater. Women hold unique insights on the issues that are important in the world and in turn provide unique approaches to solving problems.

The coming decades will be a great time to be an engineer. The world of the 21st Century is taking on a different landscape, both figuratively and literally. Workplaces are global and cultural diversity is the norm. The problems that engineers must solve are critical to the survival of future generations and the planet. The best possible solutions will be found if men and women combine their considerable talents together to lead and work in engineering teams.

I hope that the inspirational stories contained in this publication will provide you with an exciting new perspective on why engineering is a wonderful way for women to change the world.



Julie Hammer
National President, Engineers Australia



NERIDA BEARD

Environmental Engineer
Water Research, Centre for Appropriate Technology (CAT)
Alice Springs, Northern Territory



Water supplies are a hot topic throughout Australia, but in the outback water has a major impact on everyday life. That's one of the reasons Nerida Beard was attracted to her present job based in Alice Springs.

Nerida's role as Water Research Engineer with the Centre for Appropriate Technology primarily involves working with remote Aboriginal communities to improve their access to basic water supplies, through a mix of direct 'problem solving' project work and research into key remote water challenges.

The matters Nerida is called to work on range from methods of collecting rainwater and alternative sanitation options, to problems caused by hard water in communities that rely on ground water. Hard water causes hot water systems, water pipes and pumps to clog up with calcite scale and fail. "The research projects aim to inform the work we do. Technology and governance operate very differently in remote areas, and we do research to provide better information to communities, policy makers, governments and other practitioners on the issues" Often she is able to discuss issues over the phone or send information remotely, but on most occasions she visits the communities to see first hand what the problems are and work with the residents themselves to develop solutions.

Nerida studied environmental engineering at Griffith University in Brisbane. "It was quite a multi-disciplinary training and I really enjoyed the fact that we studied not only a broad range of environmental sciences but also sociology, ecological economics and the way people interact with their environments," Nerida said.

Her interest in environmental engineering had been sparked some 13 years earlier when a female environmental engineer gave a talk at Nerida's high school. It was really unusual for an environmental engineer to visit back then, let alone a female one!

"She impressed me because she had turned an industrial process in the dairy industry from a process that used a lot of energy and a lot of water and took between six and 12 hours and reduced it down to about 60 seconds through her skills and saved all this water for the dairy industry," Nerida said. "I can't remember her name, but she really impressed me with her ability to have such an impact on her environment," she added.

"I guess being so interested in the environment and learning about the sorts of damage that humans do to the environment, it seemed to me there had to be a better way and environmental engineering by definition is trying to improve the way that humans interact with our natural systems."

"With all our major systems like water, sanitation and waste management, every time we do something we have an impact. Environmental engineering is all about minimising that impact and working smarter," Nerida said.

Nerida said that working in the bush had been really interesting. "I guess when I first came out here (to Alice Springs) I thought the work would be more about the technical side of things, but that was not really the case," she said. "It's a very complex system of human development with anthropology, environmental extremes in remote places, the tyranny of distance and on top of all that you can overlay all the politics associated with indigenous affairs," she said.

Nerida was the first person in her extended family to get a university degree "which was a pretty big deal".

"I'm keen to encourage young women to enter the engineering profession," Nerida said.

"If I could go back to my high school knowing what I know now, I would tell them that engineering has been a profession that's enabled me to do lots and lots of travel," she said.

"I've always been interested in travel. It's taken me places and opened my eyes to the world around me. As an engineer, you can make the decision if you want to travel, or you can be an engineer and decide to stay in one place. I've worked in arid western Queensland on hydrogeology of river systems. I've also worked in tropical North Queensland on remote Aboriginal community water supplies and have had the chance to eat barramundi on the

beach with Aboriginal people in the Kimberly. I've learned a lot through those experiences."

"So it's been a really exciting career. I thought I would be doing a lot more indoor and office work. It does involve a lot of that, but not as much as I thought," she said.

"The door is certainly not closed to women. There are skills that women have that we can bring to the team that men often can't, including negotiating skills, particularly in community development work."

Environmental engineering has been a good broad base for understanding human systems and the environment and using that in the remote context has been really useful, according to Nerida.

She believes the first skill she gained by studying engineering was learning how to learn.

"The most important thing I learnt at uni was that if you don't know something it's just that you don't know it yet; that if you have developed the learning skills of research and critical analysis then you can learn anything," she said. "You don't get out of uni knowing everything."

The other requirement is good communication skills because the job involves a lot of group work, presentation skills, negotiation and listening skills; being able to write funding applications, write up research and be able to talk to people in group situations.

In the future working overseas is definitely on the cards for Nerida, but a lot depends on what opportunities come along. Until then she is flat out with her work helping Indigenous communities with their water problems.

"There are skills that women have that we can bring to the team that men often can't, including negotiating skills particularly in community development work."



SUE MURPHY

Civil Engineer
Planning and Infrastructure Division, WA Water Corporation
Perth, Western Australia



Despite being encouraged by her teachers to take up medicine, Sue Murphy decided to ignore their advice and became an engineer instead.

Sue didn't want to be a doctor and thought she would do something different. "I guess it was a bit of rebelliousness in choosing engineering as it wasn't seen as a very girl thing to do in those days," Sue said.

"My father is an engineer so I knew vaguely what it was and I'd always done well in maths and science which seemed to be the main prerequisite. I don't know that I really thought about it enough, but I just knew I didn't want to do medicine."

Sue thinks the sheer diversity of things that engineers cover as part of their daily role is unbelievable. "That's something I had no appreciation of when I started the journey," she said. "I don't think I was particularly motivated towards what I understood engineering to be, which is not how it ought to be, but I think I fell into something that was perfect for me as it turned out." And perfect includes ultimate responsibility for planning, design, construction and commissioning of Australia's first major sea water desalination plant in Perth.

"It has set the benchmark with every other state wanting one," Sue said. "When we started the process nobody was very keen on desalination as a solution. We started producing water last November and in the meantime, Sydney and Melbourne and the Gold Coast have all joined the band wagon. I guess it was a pivotal project in that it mainstreamed seawater desalination in this country," she said.

“The plant provides one sixth of Perth’s water supply in a climate-independent fashion so that’s the main difference. It’s definitely the reason we don’t have total sprinkler bans like every other capital city.”

Due to the current growth in Western Australia and with continued climate change issues, the Water Corporation has begun work on a second desalination plant south of Perth, which should be on line by 2011.

“Our mantra is ‘security through diversity’ so we have a wide variety of water sources, groundwater, desalination, dams, demand management, recycling, the whole suite of things to deliver the solutions because the answer can’t be one answer, it’s lots of answers,” Sue said.

“I look at a lot of the issues. We are wrestling with planning for water for Western Australia and it’s not simply about building things, it’s economic modelling. It’s looking at growth in the State, looking at where the people are, looking at the fragility of different water sources and balancing all that out, which is very much an engineering problem.”

Sue spent most of her early working life in construction, involved in a number of large projects. “On large projects your goals are very clear,” she said. “You want to finish on time and on budget so inherently everyone’s lined up and if the project is in a remote or not very pleasant location then you all want to go home, so motivation is very aligned,” she said.

“I worked on a large jetty job in South Australia when I was in my 20s and it was a fantastic group of people. We were all about the same age, we were all working hard, long hours and having a marvellous time. It was a great project all round. I think those sort of projects are the things that are high points along the way.”

Sue said she didn’t think potential engineers need to have been tinkering with car engines or building things from a very young age to be interested in engineering because engineering is actually about solving problems. “I think logical thought processes in solving problems are equally important in problems that are not so physical,” she said.

“I think people get hung up on engineering as bricks and mortar and car engines, which it’s not. It’s solving a problem with a lot of complex parameters in a way that gives you the optimum solution.”

“People who are interested in solving complicated problems that are of real importance to the world, they’re the people we want in engineering.”

So what are the skills that Sue seeks when looking for young female engineers? “I’m after the ones who boss everyone around in the playground,” she said. “I think they’re the ones who’ll be the most useful to us, the ones who don’t like things to be chaotic. The ones who like to have a way forward that makes sense and have things organised and happening right.”

Sue says engineering is about solving complicated problems. “Some of them are physical problems such as designing a building or a gas plant but some are societal problems such as ensuring water supplies for the future or ensuring environmental stability while developments are happening,” she said. “People who are interested in solving complicated problems that are of real importance to the world, they’re the people we want in engineering.”

If that appeals and resonates with young girls, then that’s the direction they should take, according to Sue. “They do need to have an affinity with maths and science,” she said.

“If these are a black mysterious world to them then they’re probably not going to cut it because even in the non-physical solution type areas you’re doing a lot of economic modelling. There’s a lot of economic modelling and basic maths logic involved in a lot of things so I guess that’s a basic pre-requisite.

“We need people who are curious about things, people who are curious about why things happen the way they do, be it why an engine works or why a building doesn’t fall over or why we do things the way we do. I think the curious kids are the ones who will probably enjoy the role.”

Sue recommends young women should look at all types of engineering. “There are as many types of engineering as there are engineers practicing and we should not pigeon hole anybody,” she said.

Meanwhile, Sue is concentrating on ensuring Western Australia has water for at least the next 50 years.



KYRIL BELLE

Biomedical Engineer
Biomedical Engineering Department, Launceston General Hospital,
Launceston, Tasmania



Kyril Belle is keen to see more engineering openings in the health industry in Tasmania and is lobbying for this to happen.

An award winning engineering student, Kyril now works in the Biomedical Engineering Department at Launceston General Hospital where she is responsible for maintaining electrical medical equipment for public and healthcare centres in northern Tasmania.

“I can see a lot of potential here similar to what other professional engineers are doing in the field across Australia and because there isn’t any professional engineering position in the health industry at the moment, in Tasmania at least, you’re quite restricted in terms of what you can and can’t do,” she said.

At the moment Kyril works in a managerial role such as asset management, advising hospital management on safety standards, what the latest technology is and what equipment to buy, which is basically desk work.

Kyril’s expertise is in biomedical engineering for which she was the winner of the inaugural 2007 Women in Biomedical Engineering Scholarship.

Her interest in this branch of engineering stemmed from having to wear hearing aids in both ears. “It was obvious to me that engineering could be used to improve lives so that’s why I decided to study biomedical engineering,” Kyril said.

Apart from her responsibilities as acting manager of biomedical engineering services at Launceston General Hospital, Kyril has also provided technical support for research projects undertaken by the Department of Anaesthetics, including involvement in a research program that tested NATO military ventilators for the Australian Army.

Kyril is one of few biomedical engineers in Tasmania, so she works hard to promote her field and talks regularly to university students about the opportunities biomedical engineering offers.

“I want to let students know how exciting biomedical engineering is and the possibilities it offers,” Kyril said. “Students are fascinated to see what biomedical engineering is all about and its benefits in the medical field.”

Kyril said that studying to be an engineer required a number of skills with the ability to solve problems high up the list. “What you learn in your four years at university is extremely useful but it doesn’t end there,” she said. “Engineering is a profession where you are constantly learning so you have to keep studying.”

“Much of what I have learnt has come after I graduated,” she said. “It’s forever a learning curve.”

She says students learn the theory at university, which is handy, and then gain the practical experience when they go to work. To this end she would like to see even more practical work whilst at university. “We had 12 weeks of practical experience that we were required to do, which in my opinion is not enough,” she said.

Kyril believes that to be a successful engineer you must be really interested in the work. “You can’t make someone a fashion designer,” she said. “But if you’re really interested in it you’ll become a fashion designer. The same applies to being an engineer. If you’re not really interested in engineering you won’t enjoy it.”

But, she says, engineering is a profession which provides great job satisfaction.

In her work with engineering students Kyril said many also wanted to talk about the ‘non-engineering’ aspects of things. “These are the skills they don’t teach at university such as managing people and resources, and the prospects for female engineers,” she said.

Kyril said she finds her role as an unofficial spokesperson for biomedical engineering very rewarding.

“One student was inspired to do prosthetics as part of her mechanical engineering course after visiting our department, and another student, who once worked in carbon filter manufacturing is keen to do biomedical engineering after seeing reverse osmosis units using such filters in dialysis machines,” she said.

Kyril said that while she has not set out to “change the planet”, she hopes that by talking to students and the general community about biomedical engineering, she can make a difference.

“I am very passionate about biomedical engineering and feel more people should be trained in Australia,” she said. “It would be fantastic to see it offered more widely at universities. If people think of engineering they think of civil or mechanical, not the smaller, niche areas such as biomedical. I want to change that.”

Kyril’s scholarship - awarded by the Biomedical College - saw her attend the Promoting Professional Women Conference in Melbourne in June 2007.

“The conference was really fantastic for me,” said Kyril. “The main thing I came away with was the difference between management and leadership,” she said. “I really identified with the suggestion that you manage with the head and you lead with the heart as those two aspects really overlap in my role.”

She said it had been great to attend the conference and talk to other women in engineering. “It was reassuring to hear people are dealing with the same issues, and inspiring to find out how they manage,” she said.

Kyril will continue to lobby on behalf of biomedical engineering in Tasmania and to encourage more young women to enter engineering as a profession.

“It was obvious to me that engineering could be used to improve lives so that’s why I decided to study biomedical engineering.”



JILLIAN KILBY

Civil Engineer
Waterway Constructions Pty Ltd
Sydney, New South Wales



Helping to build cattle yards, gates and sheds with her father on their mixed farming and grazing property near Coonamble, in the north west of New South Wales, set the course for Jillian Kilby's career.

Jillian loved the outdoor life and working with wood and coupled with her strong results in maths and science at school, it was only natural that she should look to engineering for her future employment.

"I was frequently involved in problem solving on the property and I wanted to do something that I could see the physical results of in the work that I put in," Jillian said. "So it was natural that I should turn to engineering, which was the perfect career for me and I've never looked back."

"Of course, being a top student and winning numerous awards along the way hasn't been a bad thing either."

It was during her time at Sydney University that she completed her thesis on the "*Sustainable Practices of the Hardwood Timber Industry*" involving the heritage, economic, environmental and structural factors associated with the sustainable practices of recycling hardwood and timber structure conservation."

"This introduced me to my current employer, Waterway Constructions; one of the largest specialist maritime construction contractors on the East Coast of Australia," Jillian said. "I am involved in providing technical and structural solutions and logistical support to a variety of challenges in the design, construction and maintenance of wharves and bridges across Sydney Harbour."

The work included the refurbishment of a two-storey timber building built in 1915 on timber piles over the water at Walsh Bay.

"This is definitely the most interesting and challenging project of my short work history," Jillian said. "We installed seven 30m long steel tube piles through the roof of the building, with a 200 tonne crane from the road."

“The piles had to be inserted through the two levels of the building, lowered to the sea bed and hammered to rock and were used to replace the failing timber wharf substructure. It was quite a sight. Another highlight of this particular job was that the site office was located on a two-storey floating barge on Sydney Harbour.”

Jillian was responsible for over 20 men on site at a time, programming the work, co-ordinating the design and architectural development, completing development applications, supplying information to the relevant authorities to obtain all necessary approvals and working with the NSW Heritage Office to maintain the heritage significance of the building.

It would be hard to find a more perfect location for an office so Jillian’s choice of career has already paid off.

She currently manages five projects in the Waterway Constructions Engineering Services Department.

“I enjoy the challenge engineering offers,” she said. “It has exciting projects, relevant in a society that is founded upon the built environment and the people I work with, both on site and in the office, are great.”

You could be forgiven for thinking that Jillian had plenty at work to keep her occupied but it doesn’t stop there.

The Land NSW Royal Showgirl Competition involves finding a young woman to be an ambassador for rural youth in NSW, especially women, and to represent the Agricultural Societies Council. Jillian decided to enter in 2006, and was the winner.

“I was selected from over 600 women, based on my rural knowledge and community involvement, general knowledge and current affairs, personality, confidence, ambition and public speaking ability,” she said.

“I have taken this opportunity to promote the engineering profession by not only being a well-spoken and knowledgeable ambassador for the industry, but also by talking about my experiences as an engineer,” she added. “I always emphasise the importance of young people taking on new challenges as an opportunity to develop and enhance their leadership skills, career prospects and community involvement.”

Jillian says she has a real passion for educating young women about the diversity of engineering careers that are available to them. “I feel that many young women in our schools are not aware of the exciting opportunities that are offered by the engineering profession in particular,” she said.

“It has exciting projects, relevant in a society that is founded upon the built environment and the people I work with, both on site and in the office, are great.”

One of the highlights in her short career was teaching Year 9 female students at Loreto Normanhurst College Sydney about the Civil Engineering profession. “This covered bridge design and finally hosting a bridge building competition,” Jillian said. “All 30 students wore hardhats and presented impressive paddle-pop stick bridges and I was satisfied that civil engineering is a career they not only understand now, but also find a genuine interest in.”

Jillian also sits on the Civil and Structural Panel of Engineers Australia, Sydney Division, involving the organisation of technical presentations open to the wider engineering community.

Among the many awards she has received so far are the Rod McGee Medal, 2005, awarded by the College of Civil Engineers, Engineers Australia, to recognise the contribution

Rod McGee made to public works engineering and durability. It is awarded to a student based on academic performance and motivation for a career in public works engineering.

She also received the JAL and DL Shaw Award, 2005, a memorial award presented by the University of Sydney to recognise a graduating student with high academic standards and who has made significant contributions to the life of the University or community along with the E.H. Davis Award, 2005, for the undergraduate student most distinguished in geotechnical engineering.

Earlier, she won the 2004 Jeffery & Katauskas Prize for excellence in Geomechanics, The University of Sydney and the Roads and Traffic Authority Scholarship, 2003-2005, for academic proficiency, sound communication skills and community involvement. The prize included \$12,000 per annum and 10 weeks per year undergraduate workplace training.

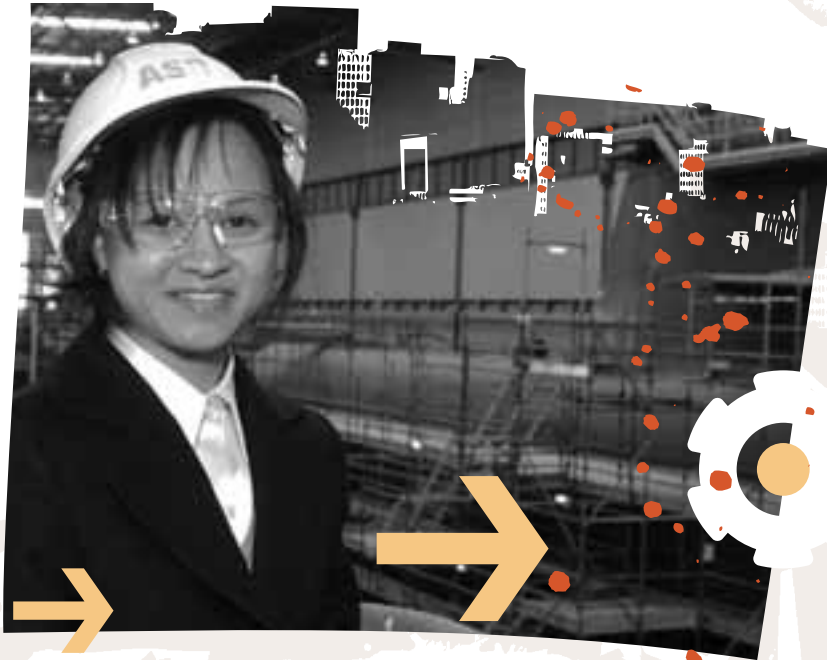
Jillian says that her biggest problem is that she likes to do everything and can’t say no. “Being young, I enjoy spending time with my family, but the biggest challenge I have found is trying to fit in all my commitments to different organisations,” she said. “I manage by keeping a good diary and can’t stress how important it is to take time out for family and friends.”

Having achieved so much in such a short time, what lies ahead for Jillian? “I would love to work overseas at some stage, but for now my main priority is to gain experience in engineering design and construction that will one day allow me to return to work and live in rural New South Wales,” Jillian said.



HA CAM NGUYEN DO

Electrical Engineer
ASC Pty Ltd
Osborne, South Australia



Managing the design phase of the upgrade of Royal Australian Navy Collins Class submarines isn't the sort of job that comes along every day, but Ha Do has recently begun work on this project and is finding it both exciting and stimulating.

The work is being carried out at Osborne in South Australia where the submarines were originally built.

ASC (formerly Australian Submarine Corporation) began construction of the first Collins Class submarine, HMAS Collins, in 1990 and delivered it to the Royal Australian Navy (RAN) in 1996. The sixth and final boat, HMAS Rankin, was delivered to the RAN in 2003.

The company has a contract with Defence Materiel Organisation for the ongoing design enhancements, maintenance and support of the submarines until the end of their operational lives. Ha's job is to oversee the project team for the design phase of the upgrade and security is a top priority.

Ha was originally interested in medicine but eventually chose the engineering profession after much research because she thought it would be a career that would provide her with the widest opportunities and steady employment.

There was no history of engineering in Ha's family as her parents were farmers and her brother has a degree in banking and international finance.

Ha Do says she believes university qualifications are extremely important and she tended to choose a career that was more science orientated than something like accountancy.

After completing a degree in electronic and micro engineering and a Bachelor Degree of Commerce, she went back to university to complete a third degree in electrical engineering because electrical engineers were in great demand at the time.

“I wanted to ensure I had a business grounding to give me better options in my career choice when I graduated,” Ha said.

“I’ve never been a person who sets my career path on a certain specialisation,” she said. “It’s more the fact that I will go with the flow and take opportunities when they come along.”

“If you single out a specific career choice, and knowing how technology can change, you can actually constrain yourself in the future,” she said.

After completing her university studies Ha was employed by ASC and recently joined the project to upgrade the Collins Class submarines.

Ha believes that engineering presents many opportunities for young women and has done a great deal of work to encourage young people to think about such a career choice. “It is multi-faceted and there are so many career options and paths open to them,” she said.

“With the current skill shortage it’s really an employee’s market right now,” she added.

“Engineering is one of the best qualifications anyone can have as it will improve your problem solving skills. Problem solving is one of the greatest recognised skills towards leadership,” she said.

She said that great communication skills are also an asset to being a successful engineer so English and literature are important. In order to get into university to study engineering mathematics, physics and chemistry are also needed. Some universities offer bridging courses to encourage more people to study engineering.

Ha said that about a decade ago it was very hard to get engineering jobs, but now it has gone the other way. “People have now recognised how important engineering is,” she said.

Travel is something that Ha looks forward to and would like to visit France “because the pastries look so tasty!!”

She has already started travelling for ASC having recently been to Hobart to present a paper at an engineering conference. Ha was the recipient of the the South Australian Young Professional Engineer of the Year Award, and will travel to Canberra as a finalist of the National Award for the Young Professional Engineer.

Ha believes the award is for a combination of the work she has been doing for ASC and her efforts for Engineers Australia.

She chairs the Women in Engineering committee in South Australia and has already helped organise a number of events that have brought young engineers together, and a 20-year celebration of women engineering in South Australia to recognise and acknowledge those who had come before them.

Ha also represented Women in Engineering at several events including one for retired engineers. “We asked for their leadership and for them to mentor and guide us,” she said.

Apart from her work, having so much to organise and attend has certainly kept Ha busy and has “helped keep me out of trouble”.

She is looking forward to more challenges in her profession and having achieved so much in such a short time she will continue to take advantage of opportunities as they arise.

“Engineering is one of the best qualifications anyone can have as it will improve your problem solving skills. Problem solving is one of the greatest recognised skills towards leadership.”



BENITA HUSBAND

Electrical Engineer
Connell Wagner
Melbourne, Victoria



Climbing one of the light towers at the Melbourne Cricket Ground during redevelopment of the Northern Stand was just one of the highlights that Benita Husband has experienced during her career as an electrical engineer.

Of course such a feat required a good head for heights but the view was amazing!!

The redevelopment of the stand had its own set of challenges as it had to be done while various sporting events went on around them.

"They demolished and rebuilt the Northern Stand in three stages," Benita said. "This meant that from an engineering point of view, we had to look at the staging of the demolition and construction work. From an electrical point of view, if there were cables running around the building they had to be re-routed so that when the cables were cut you didn't lose the lights or anything else."

Imagine the uproar if this had happened during a day-night cricket match. Benita has also worked on a major soccer stadium in China although she didn't get to visit the site.

Benita's interest in engineering didn't begin until late in her high school career. "I always enjoyed maths and science as I was growing up," Benita said. "I wanted to do something that resulted in a good career at the end of it and I was drawn particularly towards buildings because they had such a tangible outcome."

Unlike many of her colleagues, Benita didn't have a family background of engineering but it was her sister's fiancé, an electrical engineer, who gave her some pointers. "I realised it was something I could turn my interests in to," she said. So she signed on for engineering at university.

"In Tasmania your first year is common so you do a little bit of civil, mechanical and electrical engineering and then you decide in your second year what particular discipline you want to study and I decided on electrical," Benita said.

"Electrical engineering seemed to be very diverse," she said. "You've got all your electronics and it goes all the way up to high-voltage distribution and transmission so I could see that I would be left with a wide range of choices at the end of my degree."

Benita did vacation work with Connell Wagner at the end of her third year while working on her degree. "I was in their buildings group and being involved with buildings it was so tangible that when people asked me what I was working on I could point to a spot in the city and describe it to them," she added.



“Friends studying engineering who were working in government departments, looking at reporting, didn’t have such a tangible outcome so that really helped me make my decision that I wanted to get into buildings,” Benita said. So she joined Connell Wagner.

Electrical engineers design many of the major systems in buildings including the power, telecommunications and lighting. They also work on designing lifts and escalator systems and audio-visual systems.

As an Associate at Connell Wagner she has a role throughout the construction phase of projects to oversee construction and she undertakes periodic inspections to assess the progress and installation methods.

Her role might include liaising with the authorities to get a sub-station put in. “Designing a building with a data centre in it, the power requirements would be quite different to a regular office,” she said.

Benita is also working on a hospital under construction in Bahrain. She recently travelled there to make a periodic site inspection which was very exciting.

She looks forward to having more overseas projects although it depends on what comes up. “I guess what I like about consulting is that each six month-period is different to the previous six months,” Benita said. “It’s always changing.”

Benita is keen to encourage young women to consider engineering as a career. To that end she has taken part in talks with careers teachers because she believes more young women would be interested if they understood what engineering is all about.

“I don’t think that all careers teachers have the right advice to give to young women about the fact that it is a profession, that it’s very wide ranging in its opportunities, that there is a high demand for engineers and that it’s well paid,” she said.

“I guess there has been a perception that because it is male dominated that it might be a bit blokey but I haven’t found that,” she added. “There are a lot of other female engineers around so you’re not on your own and the industry is accepting women these days so it’s no longer an issue,” Benita said.

“Once you have an engineering degree there are so many opportunities open to you,” she added. “A lot of engineers get into project management or even management consulting or other roles and even technically there are so many different things you can do. It doesn’t have to be a boring black and white job. It can be really interesting and you get exciting opportunities.

“I could see that I would be left with a wide range of choices at the end of my degree.”

“There are also travel opportunities, and when I talked about lighting design, it can be quite creative and you do get to work on some amazing projects,” she said.

Benita said maths and physics are often pre-requisites for university entry so it does help to have the fundamentals but it’s also important to have good communication skills.

“One of the biggest parts of our jobs is to understand our clients’ problems so we can give them the best solutions,” she said. “To really understand your clients you need to have good communication skills.”

A lot of engineering has been streamlined by using technology and a lot of analysis is now done on the computer so it is important to have good computer skills, Benita added.

A lot of modelling and computation is now done using computers rather than by hand.

“The main thing changing in the industry at the moment is the shortage of resources,” she said. “It’s changing the way people do business and so is globalisation.

“When I started it was quite unusual to have part time engineers, but now a lot of companies want people to stay on longer before they retire and so they offer part-time positions. They have to be more flexible to keep their staff.

“In terms of globalisation, a lot more projects are done internationally so you might have

an architect in America, an engineer in Australia and it might get built in the Middle East,” Benita said. “There’s a lot more of that happening because of the use of computers and the ability to transfer files so easily.”

Benita is getting more involved in management, which she is finding to be an interesting challenge. She likes having more of a co-ordination role on projects between different disciplines and between her and the architects. “So I’m learning more about engineering rather than just focusing on my one technical area,” she said.

Meanwhile, Benita is constantly urging young people to take part in any events organised by engineering groups, many of which involve minor construction work, so they can find out more about what goes on in the profession.



DR. KAREN HAPGOOD

Chemical Engineer
Monash University
Melbourne, Victoria



Dr Karen Hapgood is one of three sisters who are all engineers and who have all travelled widely with their work.

Karen is a chemical engineer who worked for five years in the United States, during which time she worked on a drug for HIV. One of her two younger twin sisters is an electrical engineer who has worked in Tokyo and Singapore, mostly in the financial sector. The other twin is an aeronautical engineer who works for Boeing and flies all over the world, particularly with their new 787 Dreamliner.

With three totally different specialities, the sisters epitomise the range of careers that are available to female engineers. There are many others to choose from including civil and environmental engineering.

The biggest problem facing potential engineers is deciding on which branch of the profession to pursue.

Karen Hapgood was interested in chemistry at high school but wasn't sure what the difference was between chemistry and chemical engineering was until she attended a careers evening.

On the day she had to put down her university preference, Karen decided on chemical engineering, believing it would be her best chance of getting a scholarship. As it turned out she would have got one either way.

Karen was awarded a scholarship with Comalco. The scholarship also included vacation employment at their smelters and her aim was to join the aluminium industry, but that didn't happen.

Karen's first job after gaining her degree was with Honeywell, a control engineering firm working around many different sites. However, she missed the process part of it, so she decided to go back to university and do her PhD.

"I picked a supervisor who I had worked with before as an undergraduate. I chose a project on granulation, partly because it had industrial links in an area of industry that interested me. I studied the particle technology process of granulation for four years," Karen said.

Towards the end of her studies she was able to go the United States where she carried out some experiments for a firm called Merck. "I spent three months over there using their shiny stainless steel equipment and when I finished my PhD they recruited me, partly because they had road tested me!" she said.

Karen spent the next five years with Merck, including working on a drug for HIV that was suddenly in demand around the world. "It was an old drug then suddenly demand had outstripped our supply - so I was on the project to redesign the manufacturing process, of which a key part was granulation, and then to transfer that process to their Sydney site."

"That was the last project I did for Merck. It brought me home to Australia to get this HIV drug up and running, produced out of Sydney to meet world demand, which was great."

Karen was also a parent and she and her Australian husband wished to bring their child up in Australia. She heard about a position at Monash University which included some research and conference activity of which she was interested in and was closer to her husband's family. "So it was all about work-family-balance," she said.

Now that Karen is teaching chemical engineering she is in a good position to know what attributes potential engineers would need. "At school you need maths, science, chemistry and physics to get into the course," she said.

**"It's such a dynamic career.
You can go to all sorts of places
with all sorts of industries all
over the world."**

"One of the good things about engineering is that it is a very focused strategic career," she said. "When you do engineering you won't just have learnt a whole lot of other things which might not be related. You will have a coherent planned set of skills that lead up to qualify you to do something. It's such a dynamic career. You can go to all sorts of places with all sorts of industries all over the world," she said.

"I have seen everything from petrochemical refining to manufacturing of cars, aeroplanes and all kinds of manufacturing of medicines and drugs. These include those drugs for important things in the world such as HIV."

Karen is looking forward to building a research career and making progress in that field and teaching a whole range of undergraduate and postgraduate students.

It wasn't until Karen was in grade nine that she found out that she could actually be a scientist.

"I thought a scientist or a chemist in a lab coat was one of those fictional careers that you never actually be," she said.

"Guys who end up in engineering often say they rebuilt a car; my first engineering project was actually sewing my formal dress," she added. "This was a three dimensional construction involving the assembly of complicated parts. Following those patterns involved a lot of three dimensional spatial skills. So I built my formal dress, which was strapless, lined and boned; a reinforced structure."

"It was my first engineering project although not one that people would traditionally think of as an engineering project. It took me a whole year to finish it – I worked on it every Sunday for a year."

Karen said the Comalco scholarship, which was for the entire four years of the undergraduate degree including vacation work, was tremendously helpful. "They talked about women in engineering and leadership in industrial relations and dealing with all sorts of people," she said. "The scholarship was an amazing opportunity and most of my engineering knowledge came through the Comalco women involved."

Certainly if her experience and that of her engineering sisters is anything to go by, engineering has a lot to offer young women as a career.



CAPTAIN CLARE O'NEILL

Civil Engineer
Engineer Support Regiment, Gallipoli Barracks
Enoggera, Queensland



Captain Clare O'Neill was recently the project engineer on a major reconstruction project involving a regional hospital. That seems like a fairly normal occupation for a civil engineer but in this case the job was in Afghanistan as part of the reconstruction task force involving the Australian Army.

"I was the project engineer for a construction of a new out-patients department for a provincial hospital," Clare said. "We upgraded all their electrical and plumbing requirements. I was also in charge of designing regional health centres and education projects."

Working in such a dangerous situation must have been a rather exciting project but how did the locals react to the Australians?

"Initially the locals were a bit wary but it was great in the end because as Australians you get in there and do the job quickly instead of just talking about it," Clare said. "They saw us as people who were there to help them when they actually saw the bricks and mortar going up."

"We were employing the locals to actually build these projects and they soon realised they were getting economic benefits. We got to open some of the health and education projects and they really appreciated it."

Clare said it was great to be over there doing a challenging job that was both interesting and helping people out. "Afghanistan is a dangerous country but that's why they sent the military over there because we have the ability to operate safely and still do the reconstruction," she said. "It's dangerous but we know how to look after ourselves."

Clare went into both engineering and the military at the same time and regards the two occupations as a partnership. "I saw a combination of the two to be a challenging but very rewarding career," she said. "My grandfather was a civil engineer and I was good at science in High School. When I went to the Australian Defence Force Academy in Canberra there was a choice of engineering, science or arts degrees." Naturally she chose engineering.

She was interested in construction at an early age. "I remember my brother and I did all sorts of engineering projects when we were kids," she said. "I wasn't a typical barbie doll type of person. We'd be playing with mud in the back yard making our own science projects like volcanoes with hoses much to my Mum's disgust when we came back inside covered in it."

Clare O'Neill believes that engineering is a wonderful career for young women. "It's a different job to what females are traditionally placed into, but if you want a challenging and rewarding career where you get to make changes for communities, both the community and you reap the rewards of that work," she said.

"I don't think there are any fields which are not suitable for women in the engineering world," she said. "I think all engineering fields are suitable for women. I've never had a problem being a female in the army or as an engineer.

"Thankfully for me a lot of women have gone before me and broken down those barriers," she added. "I have friends who are engineers in civilian life and they don't have problems either so I feel very fortunate that those have done the hard work for me and I've been able to cruise into the job and not have any gender problems at all."

Clare was involved in an ATSIC Army Community Assistance Program (AACAP) project at Kadjina, about 230km from Fitzroy Crossing in Western Australia. This was a housing project that included construction of roads and rubbish tips for the Indigenous community. The Army has been carrying out such projects for about 11 years."

"These are really remote communities we go into and we often build single person accommodation because there are often more males than females in these communities," Clare said. "The locals are really happy to see us and we employ the locals.

"We have trade training teams when we go into these communities and we employ locals who come and get some trade skills, generally carpentry skills. They get their certificate at the end and they are really happy people."

"If you want a challenging and rewarding career where you get to make changes for communities, both the community and you reap the rewards of that work."

Clare said the Army did the same thing in Afghanistan. "Basically we took the same model we've been using over the past 11 years in the AACAP projects," Clare said. "We employed locals to work on the projects, having the trade training school in which to teach locals the trade qualification. We also built some of them ourselves.

Clare likes civil engineering because there's a whole range of different things to do. "You're not just tied down to being just a road engineer or a water engineer because your degree is so broad it gives you all the skills so you can have a very varied career which particularly in the military we need to be," she said. "What I love particularly about civil engineering is that degree of variety.

"People do become specialised. I suppose the combination of being in the military and a civil engineer is why I've never specialised," she said. "We do become very skilled at the things we do but we still work on projects with water and we do them with roads and we do them with housing and I think a lot of civil engineers do the same."

Clare said civil engineers are able to transfer their skills into a wide variety of jobs both engineering and non-engineering because of the training they receive. "We can branch into so many areas including environmental engineering," she added

Captain Clare O'Neill doesn't really know what lies ahead for her as an engineer in the Army but is happy to go with whatever comes along.

"In the army we never really know what's coming up," she said. "I'm really happy in the military at the moment and my plan is to stay in the Army and keep doing the things I'm doing. We have a set career progression that we go through and I aim to stay doing that," Clare O'Neill said.



CAROL JELLEY

Traffic Planner and Transport Engineer
Sinclair Knight Merz
Perth, Western Australia



For people who like to move around the world in their job, Carol Jelley is a fine example of what can be achieved.

Before joining Sinclair Knight Merz in Perth, Carol had worked in the UK, Trinidad, Nigeria, South Africa, Indonesia, Kuwait and finally Australia.

Her branch of engineering is transport planning and modelling which is nothing to do with building model cars. It's all about simulation of traffic conditions on a road system and forecasting what will happen given changes in population, employment, school locations, shopping centres, etc.

When Carol began studying this branch of engineering, computers were in their infancy but she was mentored by a brilliant transport engineer in her first job who encouraged her into the area of transport modelling and forecasting and building up skills that were in very short supply at that time.

"That was a very good beginning for me," Carol said. "When a lot of my colleagues were going into the more standard profession of traffic engineering I was very fortunate to go into the emerging profession of transport modelling using computer systems," she said.

"Of course in those days computers used a batch of cards which had to be typed up one by one and fed into the machine at one end and you'd wait six hours before you'd know if they had read them correctly."

"The era of using computers for transport modelling was in its infancy and I was extremely fortunate to go into a group which had one of the leading practitioners in that industry and work for him for the first couple of years."

Carol then joined a consulting organisation, Colin Buchanan and Partners, to work in public transport planning and modelling. "That was the start of world-wide travel over the next eight years working in England, Scotland, Trinidad, Nigeria, South Africa, Indonesia and finally Kuwait," she said.

“Transport engineering took me to Kuwait, which is a country I fell in love with and I left Colin Buchanan and Partners to join Kuwait Engineers Office, a consulting engineering company.” Carol stayed there for seven years before moving to Australia.

She joined Sinclair Knight and Partners (now Sinclair Knight Merz) as a transport planner and traffic engineer working on a variety of projects around metropolitan Perth and regional Western Australia.

Carol was promoted to Associate and then to Principal. “Whilst most of my time is spent working directly with our clients,” Carol said “a proportion of my time is spent in my role as transport planning sector leader, coordinating the transport planning and traffic engineering professionals working throughout our various international offices.”

When she was young, Carol and her brother were always inquisitive about how things worked. “We had Meccano sets and Scalextric slot car race track sets,” Carol said. “We used to pull things apart and put them back together. I was never a doll person.”

“I used to love jigsaw puzzles but I eventually got bored with them because I found I could do them so easily so I used to throw all the pieces in one big box and do six jigsaw puzzles simultaneously to make it more interesting.”

At university Carol did a BSc in civil engineering and then followed it straight away with a one-year Masters in transport planning and traffic engineering.

Carol believes engineering will give you the skills that you can take across the world if you want to or you can stay at home if you prefer. “Engineering allows you to problem solve so if you’re the sort of person who loves finding new solutions, engineering is an great career. It sets you challenges all the time, whatever branch of engineering you choose to go into whether it’s civil, mechanical, electrical, environmental or aeronautical.

“It’s solving challenges that really opens your mind,” she said. “Engineering is not a closed profession in that there’s no end point. Things are moving all the time. Things which appear to be the pinnacle of engineering excellence in one year are surpassed by new pinnacles of engineering excellence the following year,” she said.

“In a way I liken it to medicine as a career in that medicine is about problem solving and continuously moving forward. As society’s knowledge moves forward – you take that knowledge and you can solve more and more problems.

“If you are a person who is inquisitive,
who loves problem solving and who
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small world to a grander world,
you should think about building
a career in engineering.”



“I think engineering is in that same vein in that you will continuously be provided with fascinating challenges throughout your life and you can make those challenges as large or as small as you wish.

“If you want to go to the Middle East, for instance, then you can because your skills will take you anywhere in the world. The skills you learn as an engineer are applicable in any country in the world.”

Carol believes that if you are a person who is inquisitive, who loves problem solving and who loves to look outside your own small world to a grander world, you should think about building a career in engineering.

She says mathematics is a fundamental of engineering. “It’s all about problem solving,” she said. “It’s about saying here is a series of numbers or a series of ideas and they are trying to tell me something and if I can understand what they’re trying to tell me then that is the fundamental of engineering.”

Carol would like to see more maths teachers in schools. “There aren’t enough who make maths fun,” she said. “Our challenge is to inspire students to continue maths until the latter end of their school careers and open up opportunities for exciting careers in engineering and science.”

Carol has been WA State President of Engineers Australia and has been on the National Council for Engineers Australia for the past four years.

“What I enjoy most is passing on my knowledge to young engineers using the skills and knowledge that I’ve developed in my career over the past 30 years,” Carol said. “So that’s my challenge over the next five or 10 years, to encourage young engineers to achieve the best out of their careers,” Carol said.

She is currently working with a team from Sinclair Knight Merz in Queensland and using her skills to train the younger professionals in transport planning particularly associated with hospitals.

Although she no longer does jigsaw puzzles, she still has that inquisitive mind that sets herself challenges and loves to solve them. It’s her recipe for being a successful engineer.

EMMA GARRAWAY

Environmental Engineer
E.A. Systems Pty Ltd
Armidale, New South Wales



Growing up on a property in western New South Wales and living on bore water has given Emma Garraway a good grounding in what is required to be a successful environmental engineer.

“You see people doing it pretty tough in the country and you don’t take anything for granted,” Emma said. “Being able to help people improve their farming systems or make better use of their limited water supply is very rewarding,” she said.

Today, Emma is a senior engineer with E.A. Systems Pty Ltd producing project management and design work for major agricultural companies. Her work areas include: waste water treatment systems, feedlots, irrigation systems, water storages and mine rehabilitation.

The work covers three States so requires a good knowledge of the policies and regulations of New South Wales, Queensland and Victoria.

“You need to keep up with what is happening across the three States, which at times can be quite confusing,” Emma said.

Becoming an environmental engineer was quite accidental. “I was always strong in mathematics and science, but when it came to selecting a university program, I didn’t want to do something where I would just end up sitting behind a desk all day. I did a combined degree in environmental engineering and natural resource management,” she said. “They complimented each other, but ended up more involved in the engineering side of things than natural resource management.”



Emma grew up on a property near Mungindi on the New South Wales/Queensland border where she was involved in the family company. She could see there was a need for good up-to-date information to help people on the land.

“It’s very easy to get involved in the details with engineering, but having a broader understanding of how things work in the real world, as well as having a better appreciation of what things are achievable, is a definite asset,” Emma said.

“The longer you’re involved in engineering, the more you tend to get involved in project management roles. There’s definitely scope for you to get out there in the field and get your hands dirty,” she added.

“I’ve done a lot of site investigations, looking at soil characteristics, collecting samples, and doing project management of different construction works.

“One of the jobs I was involved with was designing a mine rehabilitation located just near a World Heritage Area,” Emma said. “We’d go out every week to the site to check on the works and make sure everything was going according to the design plans and that the contractors were happy. That was really interesting,” she said.

Emma said environmental engineering is such a growing industry and there are always opportunities to move around, but for the moment she was happy doing her present job.

“I would certainly like to do some further research at some stage,” she said. “But at the moment I’m pretty happy doing the things that we’re doing. As long as we’re doing it to the best of our ability, making some small steps towards looking after the environment and helping people on the land to make a successful and sustainable living,” Emma said.

Overseas work is something Emma looks forward to in due course. In fact she has already had some experience in Africa when she spent three weeks in Uganda and spent some time with a local water and sanitation (WATSAN) project organiser.

Emma’s local church organised a group to visit Uganda and when the locals found out she was an environmental engineer they were keen to have her look at their situation.

“I spent time looking at the local projects and how they went about raising funds, most of which came from overseas,” Emma said. “I spoke with the organiser about the possibility of going back at some stage to do some training with him.”

“Being able to help people improve their farming systems or make better use of their limited water supply is very rewarding.”

It was a real eye-opener for Emma. “In the south-west of Uganda, less than 50 per cent of the population have clean drinking water and there were children dying of diarrhoea and related causes. Dysentery was still quite common among the adults,” Emma said.

“It was fascinating looking at how they worked out which communities were in the most need and how they helped them set up a water committee or some kind of community framework so the WATSAN team could go in and help them build facilities and put in fresh water springs and train them in hygiene and health education,” she said.

Emma said some of the gravity supply schemes to supply freshwater were up to 25 kilometres long, and all the trenching was done by hand. “The local people were so appreciative which was encouraging to see, even when they had to walk a kilometre and a half to fill their water buckets.”

Emma said that engineering is such an everyday part of our life that we take much of it for granted, such as turning on the tap to brush our teeth. To this end she believes that young women who are interested in engineering as a career should become fully informed about what engineers do.

“Engineers are involved in so many areas of life that we have the benefits of a wide scope to choose from,” she said. “Look more closely at what you can do as an engineer and look past building bridges and roads,” she added.

Engineers need an ability to solve problems, so having good analytical skills is a definite asset.

“Engineering is a challenging and diverse profession,” Emma said. “No two days are the same for me in terms of the work I’m involved in, so that keeps me on my toes,” she said.

“It’s a pretty exciting time to be involved in the environmental industry because new challenges are coming all the time,” Emma said.

Having lived in the outback she knows what it’s like to watch the skies for signs of rain and how important it is to conserve every drop of water. Emma is really happy to be able to help rural industries by providing advice and assistance that makes their industry more sustainable and successful in the long-term.



DR MARLENE KANGA

Chemical Engineer
BT Risk Services and iOmniscient Pty. Ltd.
Sydney, New South Wales



Dr Marlene Kanga is passionate about engineering. Having run her own company for nearly 25 years she believes that engineering is a great profession for young women to consider and she's doing all she can to encourage them along those lines.

"Engineering has an image that it's all about hard hats and big boots but there's a lot more to it than that," Marlene said. "There's a huge range of careers. Engineering is very varied and there are so many new fields emerging all the time, like bio-technology, nano-technology and environmental engineering."

Marlene said that these areas are so varied that women could certainly contribute a great deal in all these fields. "Engineering is also very creative because you're faced all the time with problems that you've got to solve," she said. "You rely on your experience, but often it's something new that you've got to think about. Often, you've got to develop a design or a solution that hasn't existed before. This is particularly important when you are at the forefront of new technology"

Engineering requires a broad range of skills. "Yes, you've got to be good with numbers but you've also got to be good with words because it's very important to be able to communicate your ideas," she said. "I'm writing documents all the time, from proposals in order to win projects to reports which effectively communicate the results of complex technical ideas in language that can be understood by non-technical people."

Marlene said the main difficulty she faced in engineering initially was one of acceptance. "When I first came to Australia the jobs were advertised under men and boys. That was a bit of a shock to me because this was not the case in Europe," she said.

"Now that's no longer the case," she added. "There are more women entering the profession and there are many industries with a significant proportion of women so you're no longer the only woman in the team. You don't have the problem of acceptance now, it's getting a lot easier. And in the new technology areas, organisations now know that women can deliver."

Marlene said there is still a way to go in terms of providing more flexible work arrangements but that was going to come very soon. "I think just the sheer numbers are going to force organisations to think about that," she said.

“Another important aspect when considering engineering as a career is the ability to make a lasting contribution. With engineering, perhaps more so than other professions, you can often see the difference you have made. I have colleagues who have, for example, developed improvements for electronic hearing implants, worked on satellite communications, developed a better computer hard disk drive and designed a better component for a car. These are very diverse outcomes, but in each case you can say, I built that, I designed that, I made that safer, that’s with you always. No one can take that away from you.”

“An important area where engineers can make a difference is in the area of climate change. Engineers are the people with the skills required to design and implement the technology we need to redress the adverse impacts of climate change.”

Marlene Kanga’s specialisation is risk engineering. She established her own business mainly because she wanted flexibility in her work arrangements. “It was quite difficult at the time to find child care for my children and I didn’t want to leave them for long hours,” she said.

“Quite by accident I stumbled on one job and then I thought this might work if I could do this for a few years so I set up a company and I’ve never looked back. My children are at university and I still love the flexibility, the variety and the independence that comes with it.”

Risk engineering consists of analysing the likelihood and consequence of adverse events such as explosions in a chemical plant or a toxic release.

“You look at how you can reduce that risk to an acceptable level by reducing either the likelihood or consequence or both,” Marlene said.

“But you can never bring risk down to zero.”

Marlene has applied her skills to a wide range of industries in Australia and Asia including oil refineries, petro-chemical plants, power stations and various manufacturing industries and infrastructure projects. She also has a special interest in natural hazard risks and has developed models for assessing risks from earthquake and flood events.

Marlene Kanga began studying Chemical Engineering in India where she was good at mathematics and chemistry, her father was also an engineer. She studied at the Indian Institute of Technology in Mumbai. Later, she earned her Masters in Industrial Safety at the Imperial College of Science and Engineering, University of London. Both are leading engineering institutions on a world-wide scale. Marlene was awarded a DIC for her outstanding performance by Imperial College. In Sydney she completed a Ph.D. in Finance at Macquarie University.

“With engineering, perhaps more so than other professions, you can often see the difference you have made.”

Later she came to Australia with her husband, Rustom, who is also an engineer, and worked mainly in the oil and gas industry. In 1986, she was a Project Fellow at the Warren Centre for Advanced Engineering, University of Sydney on a major project in risk engineering, the first of its kind in Australia. This led to the rapid development of risk engineering in Australia.

Marlene worked on the Hazard Industry Planning Advisory Papers (HIPAP) at the New South Wales Department of Planning, the first in Australia to develop risk criteria and the methodology for Hazard Audits and Hazard Analysis. “That was a very significant achievement,” she said. The process was aimed at process safety as well as community safety.

In 2000, Marlene established iOmniscient Pty. Ltd. with her husband. This company has developed innovative new software that adds intelligence to CCTV streams from security cameras. “We are very proud that this technology was developed in Australia and has won awards on every continent. The company is growing rapidly with installed sites in major airports and other important facilities around the world. The company has 25 employees and offices in Sydney, Toronto, London and Berlin.”

Now that her two sons are at university, Marlene is looking at giving something back to the profession which has been her life.

“There are so many things that I want to do I’m not sure I’ll have enough time to do them all,” she said. Although Marlene had been actively involved with Engineers Australia before she had her children, there had been a gap while

she raised her family. Now she’s working with Engineers Australia to encourage more young women to become engineers.

“I’d also like to do some work in developing countries,” Marlene added. “There is so much technology that you can transfer there. At the moment, safety and the environment is not high on their agenda but it will be soon. They have the opportunity to leapfrog some of the problems that the developed world has experienced and that’s where the opportunity lies.”

“I am currently on the Board of three enterprises developing new technologies. I’ve been approached to join the Board of other companies. This would be another interesting challenge but I have to be selective as I do like to make a significant contribution.”

“I’ve been very fortunate in my career. I really enjoy my work,” she said. “I love the independence it’s given me in my own life,” Marlene said.



LOUISE MCCORMICK

Civil Engineer

Department of Planning and Infrastructure
Palmerston, Northern Territory



Louise McCormick has designed and built dozens of bridges in Queensland and the Northern Territory over the past few years but she's currently working on the biggest road project that the Northern Territory has ever put out to tender.

Her role is to design four major bridges for the Victoria Highway floodplain upgrade. She is also on the tender assessment panel and will be involved in the construction supervision.

"The Victoria Highway is the only link between the Northern Territory and Western Australia," Louise said. "It's a major transport route – a major highway and the project is Federally funded."

The biggest bridge crosses the Victoria River and is 300 metres long and 20 metres high to keep it above the flood levels.

"It's a very remote site located in the Gregory National Park in North Western Australia" Louise said. "There are a number of problems involved in the construction because of the remote location and the wet season can last up to six months in some years.

They have to plan the construction activities around the wet season and because of the location, there are problems sourcing the construction materials," she said. There's not much in the way of facilities for the workers so everything has to be set up specifically for the project.

"The smaller bridges which are on Joe Creek, Sandy Creek and Lost Creek are standard sort of bridges but the Victoria River Bridge is quite large and the main design aspect has to take into account the substantial flows in the river so the bridge can stand up to this," Louise said.

The people who live out that way are used to getting stranded for weeks at a time in the wet season so they are very happy about project.

The job should be completed towards the end of 2009. "The plan of attack is to wait until the current wet season is finished and get the majority of the work built before the next wet season arrives," Louise said.

"I guess I've always wanted to be an engineer," she said. "I've just been brought up in that environment because my father is an engineer and I like to design things and solve problems," she said.

She won a scholarship from the Department of Main Roads (DMR) in Queensland and during her university studies she did vacation work for the district office in Toowoomba.

She was bonded for three years after completing her degree so she asked to work in the bridge design section.

"Civil engineering is quite a broad field but I prefer structures to other parts of civil engineering mainly because I feel I'm creating something," she said. "I've always been a bit creative in that regard.

"We used to live next to an old steel truss bridge when we lived in Goondiwindi and maybe that had an influence on me," she said.

Louise spent a further five years with DMR before moving the Northern Territory. "I was looking for a new challenge and to get a bit more variety in my work," Louise said.

"Since I came up here, I've been able to do not just bridges, but wharves and buildings, so there's a lot more variety for me," she said.

"We had a culvert taken out by Cyclone George; Jabiru was cut off for a about a month," she said. "We had to get a bridge in and built as soon as possible and during the wet season so Jabiru could get the basics like bread and milk again," she said

"We built the bridge over the top of the culvert where the banks were a bit dryer and I had to helicopter in every now and again to inspect things.

"The bridge was designed and built within four weeks of the identified failure," she said proudly." It was awarded a highly commended in the engineering excellence awards in the Territory and I believe it's being entered in the national awards 2007."

"Many girls think engineering is all about maths and science but there are many ways you can contribute to engineering."



As to the future, Louise will eventually have to decide on going into a senior management role or specialise further in design and construction. "I haven't decided which way I want to go but these are the main two options open to me".

Meanwhile, she's keen to encourage more young women to consider engineering as a profession.

I think many girls think engineering is all about maths and science, but there are many ways you can contribute to engineering," she said. "I like to encourage them to look at it in a bit more depth and see that it's not just maths and science, but there's a lot of creative problem solving.

"When you get into management there's a lot of project management, research and human relations type issues that you deal with everyday, not just maths and science,

You can be as practical as you like or as academic as you like because there's a range of work. You can be an academic or a researcher at university or you can be out in the field doing construction or in an office designing on a computer.

A lot of engineers end up in different fields but still in management positions because of the skills they gained doing an engineering degree.

Louise said that she had designed about 200 bridges in Queensland. "I now know basically how to design a bridge on the back of my hand," she said.

Louise said bridges are a major component of any road system. "I think people forget because a lot of the bridges you tend to just drive over and don't know they are there. But if you didn't have them, you would be stuck."

"I think they feel it more up here than down south where people tend to forget about bridges because when it floods it doesn't affect them. "But up here, because there's a lot of crossings that don't have bridges it really does affect communities being cut off and it can be a real show stopper."

There's no doubt that engineering is playing a big part in Louise's life and that her work is bringing great benefit to many people in the remote areas of the Northern Territory.



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